Phase I Report - April - May 1973

EVALUATION OF ERTS DATA FOR CERTAIN HYDROLOGICAL USES

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ERTS Proposal NASA No. 109
GSFC ID No. C0313
Task No. 432-641-14-04-03

SIGNIFICANT RESULTS

1. The authors have detected melting ice in Lake Erie by comparison of visible and near-IR differential reflectance. This melting condition is confirmed by meteorological ground truth data and concurrent NOAA-2 thermal IR data.

2. Using near-synchronous ERTS-1 data the authors have determined the approximate ground resolution of NOAA-2's VHRR (Very High Resolution Radiometer) by comparing the smallest identifiable ice crack in the VHRR image and measuring the same crack on the ERTS-1 image. The NOAA-2 VHRR (VIS) is detecting cracks as small as 600 meters. The cracks are a high-contrast linear type of target.

3. Photointerpretation and analysis of a single Lake Erie image (e.g. 18 Feb 1973) can, under certain conditions, provide meaningful data on ice dynamics. Preliminary estimates of ice movement, range from 800 m/hr, to 300 m/hr, (0.43 to 0.16 knots) to the west. Strong (personal communication) using the side lap on successive days of ERTS-1 passes was able to plot ice movement that ranged from 1500 m/hr (0.81 to 0.27 knots). Considering the fact that time of onset of motion is not precisely known, these figures are in rather good agreement. Significantly, the wind that induced this movement was a relatively light wind (10 knots or 18,500 m/hr.).

ERTS-1 imagery is outstanding for ice pack monitoring of the Great Lakes. Frequency of sampling interval (18 days) is however a severe limitation.

4. Maps of the snow cover in the American River basin for 16 March 1973 have been prepared using all 4 bands. Band 5 (0.5-0.6μm) imagery gave a

figure of 46% of the basin snow covered; band 5 (0.6-0.7μm) gave a figure of 44% of the basin snow covered; band 6 (0.7-0.8μm) gave a figure of 45% of the basin snow covered; band 7 (0.8-1.1μm) gave a figure of 40% of the basin snow covered. Band 7 is the near-IR band which characteristically reflects less energy for snow; especially when the snow is undergoing melting conditions. Using the Zoom Transfer Scope this 2100-mile^2 basin can be mapped in about 30 minutes under cloudfree conditions and the percent of snow cover can be determined in about 30 minutes.

5. ERTS-1 imagery of the Feather River Basin for 29 Nov. 1972, 4 Jan. 1973, and 22 Jan. 1973 were utilized in mapping snow area extent. ERTS-1 mapping was found to be about 6 times faster than a similar attempt using U-2 high-altitude photography in the Zoom Transfer Scope.

6. A comparison of ERTS-1 and NOAA-2 satellite snow maps for the American River basin for 2-3 April 1973 and 15-16 March 1973, as shown on Table 1, provide evidence that not only ERTS-1 but also NOAA-2 is capable of providing snow extent maps for small (2100-mile^2) basins that can be used as input data for river forecast models. A sample map is shown at 1:500,000 scale (fig. 1).

Work Plans:

Continue snow mapping of L. Ontario basin using both ERTS-1 and NOAA-2 for comparison of results and accuracy.

ERTS digital data over L. Oneida test site and over Scipio, N.Y., test sites will be rerun in the computer with new enhancement procedures.

Examination of VHRR and ERTS imagery for snow thickness as it relates to reflectance values will be carried out. If it appears feasible, we will evaluate the usefulness of ERTS for snow thickness.

Problems: A staff reduction has affected our office. One employee, a technician who was working about 75% on ERTS work, has left. This decrease in personnel will slow down the mapping and some of the analysis of new data.

Figure 1. Example of snow mapping in the American River Basin (drainage area 2100 sq. mi.) based on ERTS-1 orbit 3542. The hatch portion of the figure represents the snow-covered area of the basin, amount to 50 percent.

Objective:

The overall objective of this investigation is to evaluate ERTS data for hydrologic information in two areas in which extensive ground truth is available.

a. Sierra Nevada studies.--Here the objective is to evaluate ERTS data from a mountainous region with extensive ground truth and where a prolonged melting snowpack is the primary source of surface runoff to a highly managed river system. To determine--by comparing satellite and ground truth data--the feasibility of indirect quantitative assessments of water storage in reservoirs and possibly in the snowpack as snow. Snow mapping in mountainous terrain is an extremely challenging task.

b. Lake Ontario (IFYGL) studies: Here the objective is to assess in a quantitative way, the ERTS data from a temperate region lake and from its drainage basin, in terms of hydrologic information content, relating ground truth to spectral band, ground resolution, etc. Coincident use of ITOS-D imagery and data will permit evaluation of the effect of the 18-day revisit cycle on hydrologic phenomenologic monitoring.

PRELIMINARY COMPARISON OF SNOW MAPPING BY ERTS-1 AND NOAA-2

AMERICAN RIVER BASIN, CALIFORNIA

DATE	ERTS-1	NOAA-2
3/15/73	46%	46%
4/2/73	45%*	48%*

*Average of 4 trials, 2 operators. Each trial consists of 3 areal measurements.